

PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Disengageable Coupling for Joints

We, GESELLSCHAFT FÜR INDUSTRIAL DESIGN DEVICO A.G., of Gockhausen, Zurich, Switzerland, a Swiss Body Corporate, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a disengageable coupling between two or more members utilising separate elements anchored in the members, the members being subjected to pressure by means of a tensioning device. Such couplings may be used, for example, in furniture making and are particularly useful for add-a-unit furniture.

A known disengageable coupling comprises pins which are knocked into the ends of the members to be connected. The head of each pin engages another member and each pin is held in position by an inserted sleeve. This known arrangement is only suitable for light couplings, as the pins, which are provided with a wood-screw thread, are pulled out of engagement with the associated members when subjected to considerable tension.

The present invention consists in a disengageable coupling for connecting two or more members together comprising two or more tongues, each tongue having at least one hole therein, and eccentric elements, each eccentric element being insertable through a hole in a tongue, the members to be connected each having a corresponding hole of a size just sufficient to receive the eccentric element, whereby when each tongue of a coupling is aligned with a member, an eccentric element may be inserted through the corresponding holes such that rotation of each element causes the element to bear against a portion of the peripheral surface of the hole

in the tongue so as to hold and press the members together.

In one embodiment of the invention the tongues of the coupling are rigidly connected together. In another embodiment the coupling comprises two or more separate tongues. When the coupling comprises several tongues, the tongues may either be individually connected to a joining member or two tongues may be adapted so that one tongue passes through a slot in another tongue. The coupling may also be provided with lugs which engage the members.

When the join has been completed the coupling is wholly or partly hidden by the members. The tongues of the coupling are inserted into slots made in the members. The tongues may also be inserted into members having a profiled cross-section. The coupling may also be used to joint members of laminated structure.

The eccentric element comprises an eccentric disc and one or two guide cylinders. One side of the hole through the member may be closed by means of a cover. The eccentric disc may be rigidly or removably attached to the guide cylinders.

In the most used embodiment the eccentric disc is rigidly attached to at least one guide cylinder. The guide cylinder or the eccentric disc is provided with a locking plate. A lift-way is provided in the plane of the eccentric disc. At its outer end the guide cylinder has an annular groove to enable the cylinder to be lifted out of the member. The outer face of the guide cylinder has a projection or a recess for tightening or loosening the eccentric. Preferably the guide cylinder has a recess adapted to receive a coin.

The eccentric disc may also be in the form of a separate part which is loosely placed in the perforation of a tongue. In another em-

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bodiment the eccentric disc is connected to the tongue inside the perforation by means of webs which may be readily sheared. The guide cylinder then engages the eccentric disc by means of a pin. Alternatively, two guide cylinders can engage the eccentric disc, one from each side.

The locking plate may be rigidly or rotatably attached to the guide cylinder. The rotatable locking plate is turned by means of a pin mounted in the guide cylinder.

In addition, an arresting device is provided to hold the eccentric disc in its operative position. The arresting device is anchored in the member forming part of the join and engages the recess in the end of the guide cylinder. It may comprise a U-shaped element whose centre portion engages the recess in the end of the guide cylinder and whose ends are knocked into the member. Another form of the arresting device comprises a plate having lugs which engage the recess in the end of the guide cylinder and also having points adapted to be knocked into the member.

The coupling elements may also consist of key-type strips to which the members are attached by keying.

For example, the coupling element can have a wedge surface at one end which dovetails with a wedge key bed in the member. Connection between the two is effected by inserting one into the other from above and applying vertical pressure.

The invention is further described with reference to the accompanying drawings, which illustrate several embodiments of the invention and in which:—

Fig. 1 is a section of an angle joint;

Fig. 2 is a plan view of part of the joint shown in Fig. 1;

Figs. 3, 4 and 5 show diagrammatically an angle joint, a A-joint and a cross joint respectively;

Figs. 6 and 7 show diagrammatically an angle joint and a T-joint respectively incorporating engaging projections;

Figs. 8 to 11 show an angle joint and a T-joint where the coupling elements are not completely hidden;

Figs. 12 to 14 show joints at arbitrary angles;

Fig. 15 is an exploded perspective view of part of a joint;

Fig. 16 is an exploded perspective view of a corner joint;

Fig. 17 is an exploded perspective view of a covered corner joint;

Fig. 18 is a perspective view of a star joint;

Fig. 19 is a side elevation of an angle joint with a corner support;

Fig. 20 is a section of the arrangement shown in Fig. 19;

Fig. 21 is a section corresponding to Fig.

20 but showing a different coupling element;

Fig. 22 is a perspective exploded view of the arrangement shown in Figs. 19 and 20;

Fig. 22a is a part-exploded perspective view of a multiple joint;

Fig. 23 is an exploded perspective view of a joint incorporating bent-over tongues;

Figs. 24 to 28 are perspective views of coupling elements which may be inserted into each other;

Fig. 29 is a perspective view of a cross joint between hollow bodies;

Figs. 29a and 29b are a side elevation and plan view respectively of an eccentric element;

Fig. 29c is a perspective view of the eccentric element shown in Figs. 29a and 29b;

Figs. 30 to 33 are a side view and three sections of corner joints incorporating separate tongues;

Fig. 34 is a perspective view of a corner joint between laminated members;

Figs. 35 to 37 are a side elevation, plan view and perspective view respectively of an eccentric element;

Figs. 38 to 41 are a side elevation, plan view and perspective views respectively of an eccentric element with cover;

Figs. 42 and 43 are a side elevation and section of an eccentric element with guide cylinder and locking plate;

Figs. 44 and 45 are perspective views of the arrangement shown in Figs. 42 and 43 but with separated eccentric disc;

Figs. 46 and 47 are a side elevation and plan view respectively of an eccentric element having a guide cylinder on both sides;

Figs. 48 to 50 are perspective views of the parts shown in Figs. 46 and 47;

Fig. 51 is a plan view of a coupling tongue having shearably connected eccentric discs;

Figs. 52 and 53 are a section and perspective section respectively of an arresting device for the guide cylinder;

Figs. 54 and 55 are sections of other embodiments of the arresting device;

Figs. 56 and 57 are a section and perspective view respectively of another embodiment of the arresting device.

According to Figs. 1 and 2 an angle joint is formed from two members 1, 2 and one coupling element 3. The coupling 3 has two tongues 4, 5 which are inserted in slots 6, 7 in the members 1, 2. The joint is held together by means of eccentric discs 8 and 9 inserted into perforations 10, 11 in the tongues 4, 5. The eccentric discs may be tightened by means of a guide cylinder 12 and 13 respectively.

Fig. 3 shows diagrammatically the angle joint depicted in Figs. 1 and 2. The T-joint of Fig. 4 and the cross joint of Fig. 5 are produced in a similar manner. In order to prevent spreading of the members on tightening, the coupling elements 14 and 15 shown

in Figs. 6 and 7 may have projections or lugs 16, 17. In all of these embodiments the coupling elements are hidden by the members.

The members 18 and 19 in Fig. 8 and the members 20 to 22 in Fig. 9 are provided with uniform joining ends. This is made possible by the use of the coupling elements 23 and 24 which have suitable lugs 25, 26. These lugs 25 and 26 may conveniently be enlarged, as shown in Figs. 10 and 11, so that they are flush with the outer surface of the members. In such cases the lugs 25 and 26 (Figs. 8 to 11) are not hidden.

In Figs. 12 to 14 the members are arranged in various star joints by means of appropriate coupling elements 27 to 29. Again, it is possible for the members to have uniform joining ends, as shown in Fig. 14, when the coupling elements must be provided with lugs 30, 31.

The perspective view shown in Fig. 15 illustrates how members 32 and 33 are connected to the coupling element 34 by means of eccentrics 35 and 36. This construction enables raised or sunk profiles of any shape to be joined, the angle at which they meet being unimportant.

According to Fig. 16, a corner joint can be made between members 37 to 39 meeting at right-angles by using separate coupling elements 40 to 42. Corner joints at other angles are equally possible, for example, in the production of an octahedron.

It is also possible to construct a corner joint where the elements are hidden, as shown in Fig. 17. The members 43 and 44 are joined by the element 45, whilst the member 64 connected to elements 47 and 48 is added.

Several members 49 to 53 (Fig. 18) may form a star joint with the use of a suitable coupling element 54.

The angle joint shown in Figs. 19 and 20 illustrates how the members 55 and 56 positively engage, under tension, in the member 57 so that the forces acting on the members are directly transmitted from one member to the other without the coupling element 58 and the eccentrics 59 and 60 being additionally stressed. In the embodiment shown in Fig. 21 a different coupling element 61 is used which utilises the entire cross-section of the member 57. To make the construction of Figs. 19 and 20 clearer, it is shown in perspective in Fig. 22.

A development of this last construction is shown in Fig. 22a, where by means of a star-shaped coupling element 156 it is not only possible to connect three lateral members 157 to 159 but also to positively connect and clamp in two members 160 and 161 placed at right-angles to the lateral members. To this end the joining ends 162 of the members 157 to 159 have an inward taper, as is again illustrated at the outer end 163. The members 160 and 161 are provided with corresponding

grooves 164 whose bases slope inwardly in the vertical direction. This construction makes it possible to assemble structures which are suspended from above.

It may happen that the cross-section of the members to be joined calls for bent-over coupling elements, as shown in Fig. 23. In this embodiment the tongues 63 and 62 of the coupling element 64 are bent through 90°. They are received in slots 65 and 66 in the members 67 and 68 and pressed against a supporting member 71 by means of eccentrics 69 and 70.

According to Figs. 24 to 28 the coupling elements may be composed of separate parts. In this case the tongue 72 is provided with a back strip 73 and a slot 74. Another tongue 75 with a back strip 76, as shown in Fig. 25, can be inserted through the slot 74 of the tongue 72, as illustrated in Fig. 26. Figs. 27 and 28 show other forms of this type of tongue.

It is also possible to joint members with a profiled cross-section. Fig. 29 illustrates the connection of four such members 77 to 80 by means of a cross-shaped coupling element 81.

A convenient form of eccentric is shown in Figs. 29a to 29c. This eccentric has a guide cylinder 153 and a rigidly attached eccentric disc 154 and another guide cylinder 155 of smaller diameter. With this type of eccentric the member and the tongue are symmetrically loaded.

Figs. 30 to 33 show how members with a hollow cross-section may be used to hold separate tongues. In this case it is convenient to arrange for the individual tongues 82 and 83 to be able to slide into slots in the member 84 from the open end of the slot. The adjoining members 85 and 86 are then tightened into position by eccentrics 87 in the usual manner, as shown in Figs. 30 and 31. Figs. 32 and 33 show further forms of this type of coupling.

The members to be joined may be laminated, as shown in Fig. 34, which illustrates, by way of example, a corner joint between such members 88 to 90 made by coupling elements 91 to 93. Through ducts may be provided in the layers of the members, as shown at 94 to 99.

According to Figs. 35 to 37 an eccentric disc 100 is connected to a guide cylinder 101. A locking plate 102 causes the eccentric disc 100 to be drawn into the hole in the tongue when the guide cylinder 101 is turned. When the eccentric disc 100 is turned in the opposite direction, a liftway 103 bears against the tongue to cause the guide cylinder 101 to project out of the member, from which it can be lifted by means of the annular groove 104. The recess 105 allows for rotation of the eccentric, for example by means of a coin.

Figs. 38 to 41 show a similarly constructed

eccentric disc 100 with guide cylinder 101. In addition, a cover 106 having a guide pin 107 is provided, the latter being located in a central bore 108 in the guide cylinder 101. The bore 108 extends as far as the recess 105 so that the pin 107 may be knocked out from the recess end. The purpose of the cover 106 is to close one end of the bore in the member should it be a through bore.

Figs. 42 to 45 show another form on the eccentric disc 109, which in this case is a separate part and has an aperture 110. The guide cylinder 111 has a plug portion 112 of a cross-section corresponding to that of the socket aperture 110 in the eccentric disc 109. A separate locking plate 113 has the same cross-section and can be turned by means of a pin 114 which is rotatably located in the guide cylinder 111. When the guide cylinder 111 is inserted into the member the locking plate 113 and the plug portion 112 must be in register so that these parts can pass through or into the aperture 110 in the eccentric disc 109. The pin 114, which is provided with a recess 115 is then turned so that the locking plate 113 may hold the eccentric disc 109 in position on the guide cylinder 111.

According to Figs. 46 to 50 a separate eccentric disc 116 having a cross-shaped aperture 117 can be actuated from both sides by means of guide cylinders 118 and 119. The latter engage in each other by means of projections 120 and 121 which correspond to the apertures 117. The recesses in the interior of the guide cylinders 118 and 119 partly extend as far as the coin recesses 122 and 123 so that each guide cylinder can be knocked out of the member.

When it is required to make a joint, the separate eccentric discs must be loosely placed in the tongues of the coupling element. This measure can be simplified, as shown in Fig. 51, by arranging for the eccentric discs 124 to 126 to be connected to the tongue 130 by means of small webs 127 and 128. When the eccentric discs 124 to 126 are turned inside the perforations 131 to 133, the webs 127 and 129 break on account of the shearing action produced.

In the case of extreme stresses, particularly alternating stresses, it is possible to provide an arresting device, as shown in Figs. 52 to 57. The arresting device 134 of Figs. 52 and 53 comprises a shaped strip with pointed ends 135 and 136. It is placed in the coin recess 137 of the guide cylinder 138 and depressed so that the pointed ends 135 and 136 are forced into the member 139 made, for example, of wood.

The arresting device 140 of Fig. 54 comprises a metal rod or strip and operates in a similar manner. The end 141 is first knocked into the member 139 from the side and then the end 142 is knocked in from above. The arresting device 143 of Fig. 55 has pointed

ends 144 and 145 which are knocked in the member 139 from above.

Figs. 56 and 57 show another arresting device 146 in the form of a plate. Lugs 147 and 148 are cut out of the plate and bent so as to engage the recess in the end of the guide cylinder. The points 149 to 152 are then knocked into the member so as to anchor the plate.

From the above-described embodiments a distinction can be drawn between members which are directly interconnected by the coupling elements and those which are merely held in position on account of the co-operative action of members of the first type. The first type of member receives a tongue and eccentric, whilst the coupling elements are merely supported by members of the second type. Both functions may occur in one member, though at different points.

WHAT WE CLAIM IS:—

1. A disengageable coupling for connecting two or more members together comprising two or more tongues, each tongue having at least one hole therein, and eccentric elements, each eccentric element being insertable through a hole in a tongue, the members to be connected each having a corresponding hole of a size just sufficient to receive the eccentric elements, whereby when each tongue of a coupling is aligned with a member, an eccentric element may be inserted through the corresponding holes such that rotation of each element causes the element to bear against a portion of the peripheral surface of the hole in the tongue so as to hold and press the members together.

2. A disengageable coupling as claimed in claim 1 wherein the tongues of the coupling are rigidly connected together.

3. A disengageable coupling as claimed in claim 1 in which the coupling comprises two or more separate tongues.

4. A disengageable coupling as claimed in claim 1 in which the coupling comprises several separate tongues and are individually anchored in one member.

5. A disengageable coupling as claimed in claim 3 in which one tongue passes through a slot in another tongue.

6. A disengageable coupling as claimed in claim 1 in which the coupling has lugs which engage the said members.

7. A disengageable coupling as claimed in claim 1 in which the coupling is wholly or partly hidden by said members.

8. A disengageable coupling as claimed in any preceding claim in which the tongues of the coupling are inserted into slots in the said members.

9. A disengageable coupling as claimed in claim 1 in which the tongues of the coupling are received by members which have a profiled cross-section.

10. A disengageable coupling as claimed in claim 1 in which the coupling connects laminated members.
- 5 11. A disengageable coupling as claimed in any preceding claim wherein the peripheral surface of the hole of each tongue acts as a guideway for the eccentric element.
- 10 12. A disengageable coupling as claimed in claim 11 wherein the eccentric element comprises an eccentric disc and one guide cylinder.
- 15 13. A disengageable coupling as claimed in claim 11 wherein the eccentric element comprises an eccentric disc and two guide cylinders.
14. A disengageable coupling as claimed in claim 12 wherein the opening of the hole on one side of the member is closed by a cover.
- 20 15. A disengageable coupling as claimed in claim 12 or 13 wherein the eccentric disc is rigidly connected to the guide cylinder(s).
16. A disengageable coupling as claimed in claim 12 wherein the eccentric disc is removably connected to the guide cylinder.
- 25 17. A disengageable coupling as claimed in claim 13 wherein the eccentric disc is removably connected to the guide cylinders.
18. A disengageable coupling as claimed in any of claims 12 to 17 in which the guide cylinder or the eccentric disc is provided with a locking plate.
- 30 19. A disengageable coupling as claimed in any of claims 12 to 18 in which there is provided a liftway in the plane of the eccentric disc.
- 35 20. A disengageable coupling as claimed in any of claims 12 to 19 in which the guide cylinder has an annular groove at its outer end for lifting purposes.
- 40 21. A disengageable coupling as claimed in any of claims 12 to 20 in which the end face of the guide cylinder has a projection or a recess for tightening and slackening the eccentric.
- 45 22. A disengageable coupling as claimed in claim 21 in which the guide cylinder has a recess adapted to receive a coin.
23. A disengageable coupling as claimed in claim 17 in which a separate eccentric disc is loosely located in the perforation of a tongue.
- 50 24. A disengageable coupling as claimed in claim 17 in which an eccentric disc is connected to the tongue in side the perforation by means of shearable webs.
- 55 25. A disengageable coupling as claimed in claim 16 in which the guide cylinder has a projection which engages in the eccentric disc.
26. A disengageable coupling as claimed in claim 25 in which a locking plate is provided on the side of the eccentric disc remote from the guide cylinder.
- 60 27. A disengageable coupling as claimed in claim 26 in which said locking plate is mounted for rotation in the guide cylinder.
28. A disengageable coupling as claimed in claims 26 and 27 in which said locking plate can be turned by means of a pin located in the guide cylinder.
- 65 29. A disengageable coupling as claimed in any of claims 12 to 26 in which an arresting device is provided to secure the eccentric disc in the operative position.
- 70 30. A disengageable coupling as claimed in claim 29 in which the arresting device is anchored in the member and engages the recess in the end of the guide cylinder.
- 75 31. A disengageable coupling as claimed in claim 30 in which the arresting device comprises a U-shaped element whose centre portion engages the recess of the guide cylinder and whose ends are knocked into the member.
- 80 32. A disengageable coupling as claimed in claim 29 in which the arresting device comprises a plate having lugs which engage the recess of the guide cylinder and points adapted to be knocked into the member.
- 85 33. A disengageable coupling as claimed in claim 1 in which the coupling elements comprise wedge-type strips to which the said members are attached by keying.
- 90 34. A disengageable coupling as claimed in claim 33 in which the coupling element has a wedge surface at one end which dove-tails with a wedge key bed in the member.
- 95 35. A disengageable coupling as claimed in claim 34 in which connection between the coupling element and the member is effected by inserting one into the other from above and applying vertical pressure.
- 100 36. A disengageable coupling as claimed in any preceding claim wherein each tongue has a plurality of holes.
37. A disengageable coupling substantially as herein described with reference to the accompanying drawings.
- 105 38. Articles in which members are joined by a coupling as claimed in any one of claims 1 to 37.

MARKS & CLERK,
Chartered Patent Agents,
Agents for the Applicant(s).

Fig.1

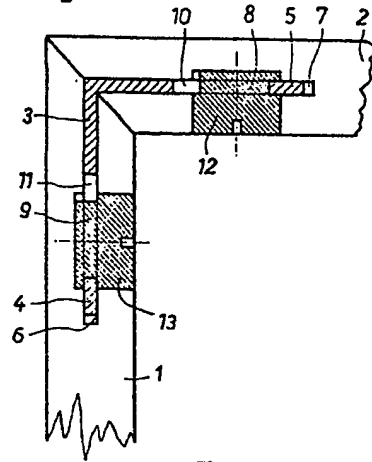


Fig.2

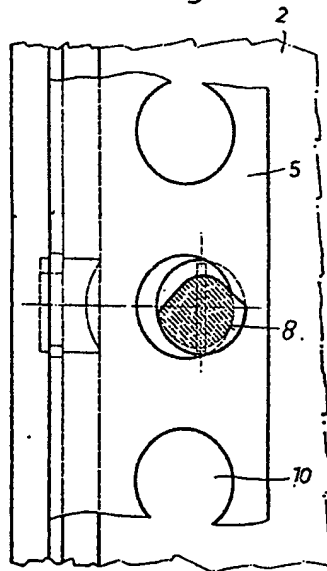


Fig.3



Fig.4

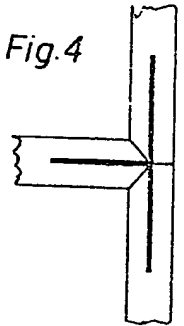


Fig.6

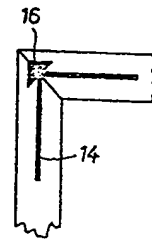


Fig.7

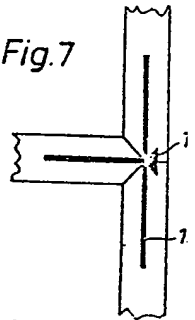


Fig.8

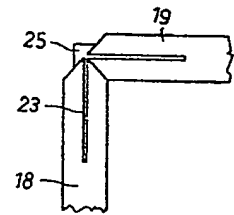
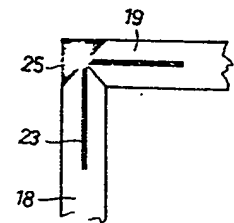


Fig.10



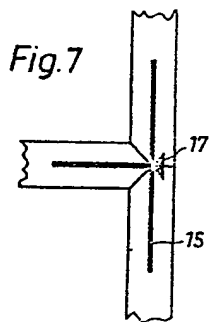
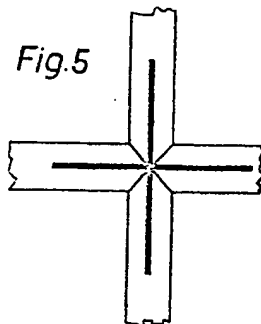
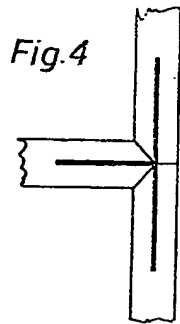


Fig.8

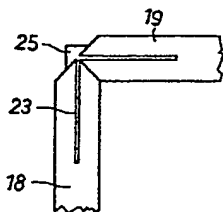


Fig.9

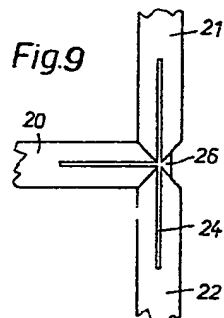


Fig.10

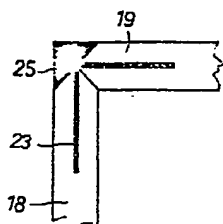


Fig.11

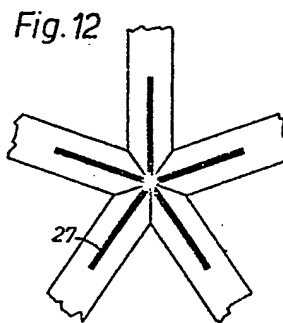
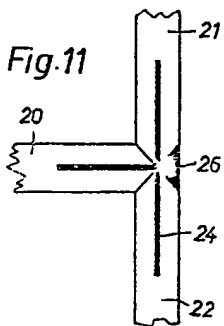


Fig.13

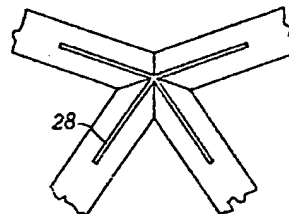
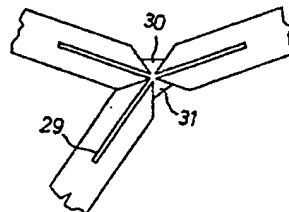


Fig.14



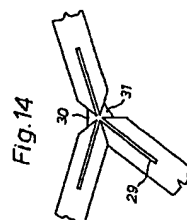
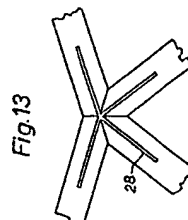
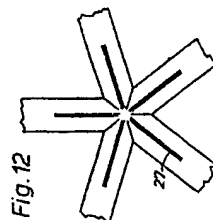
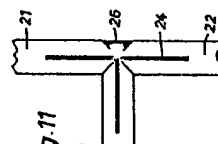
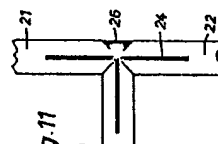
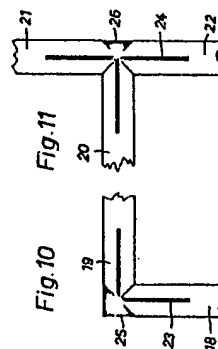
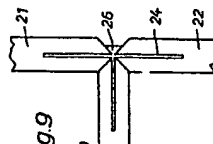
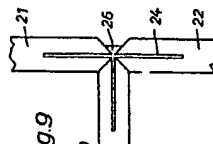
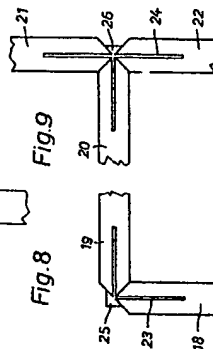
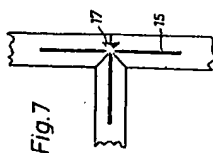
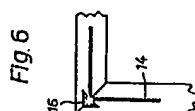
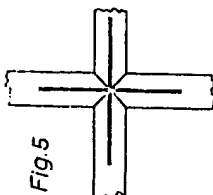
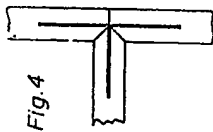
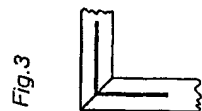
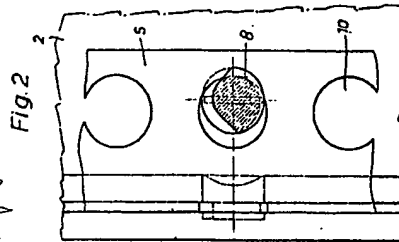
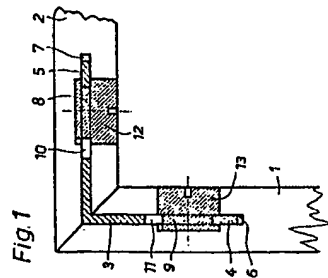
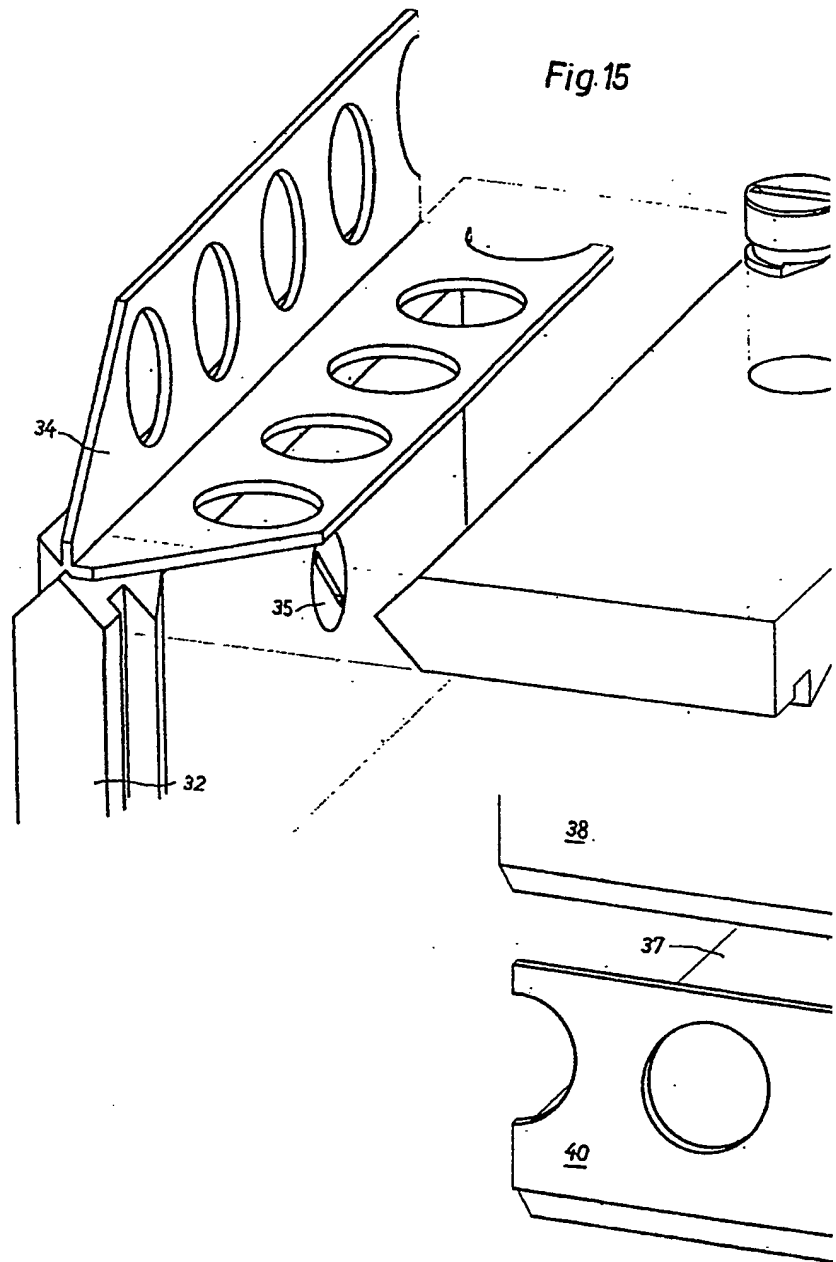


Fig. 15



g.15

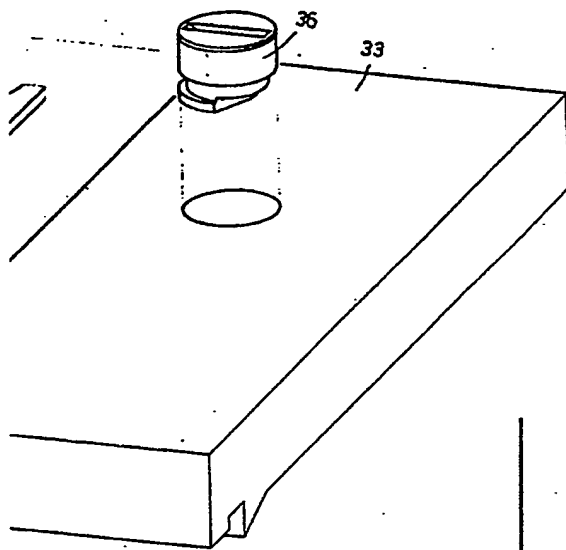
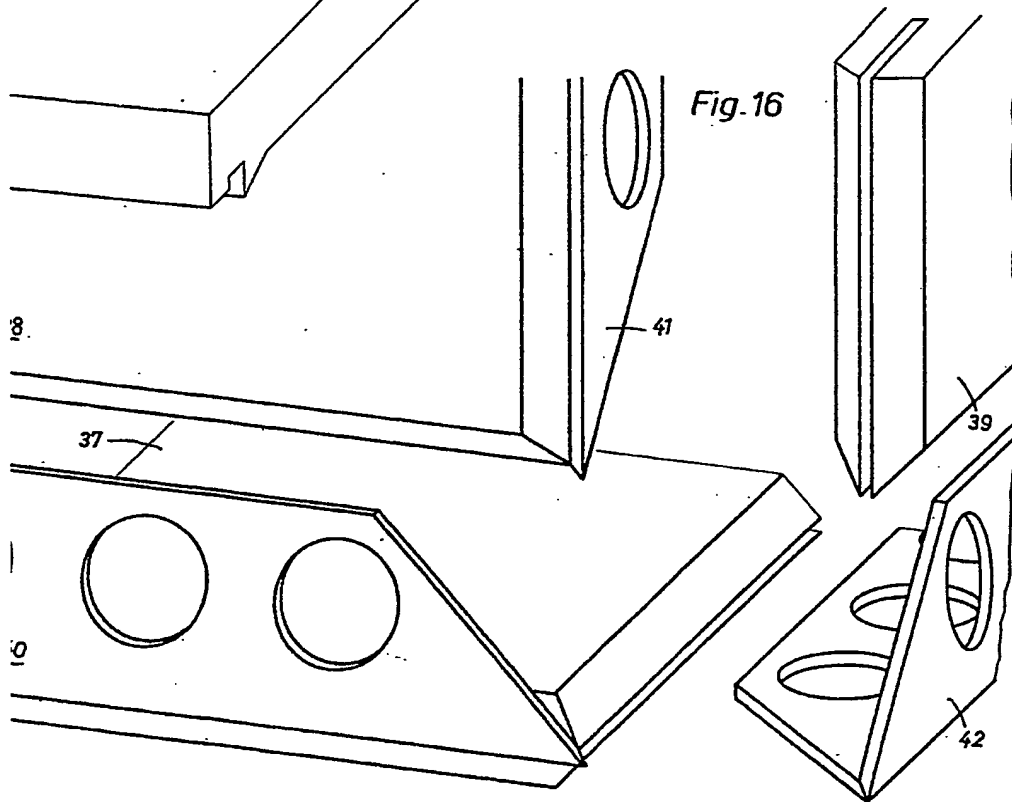


Fig. 16



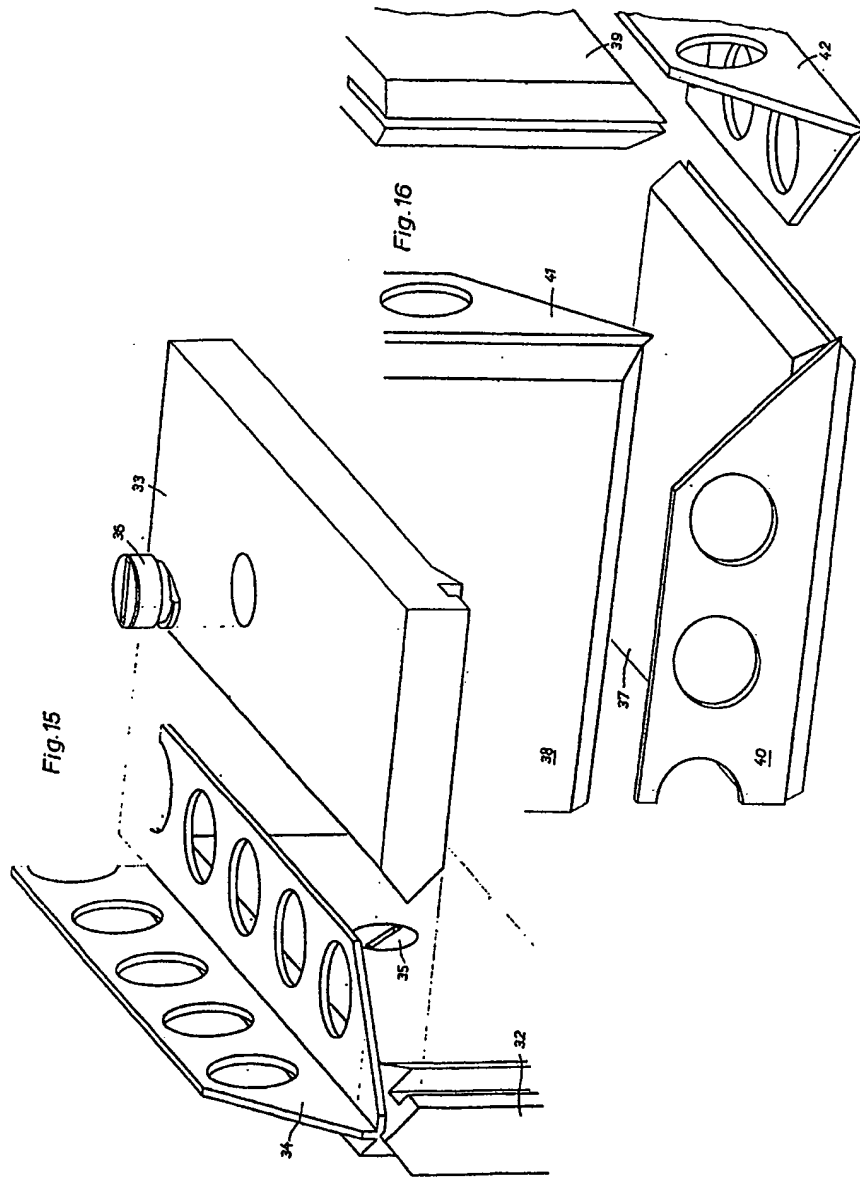


Fig. 17

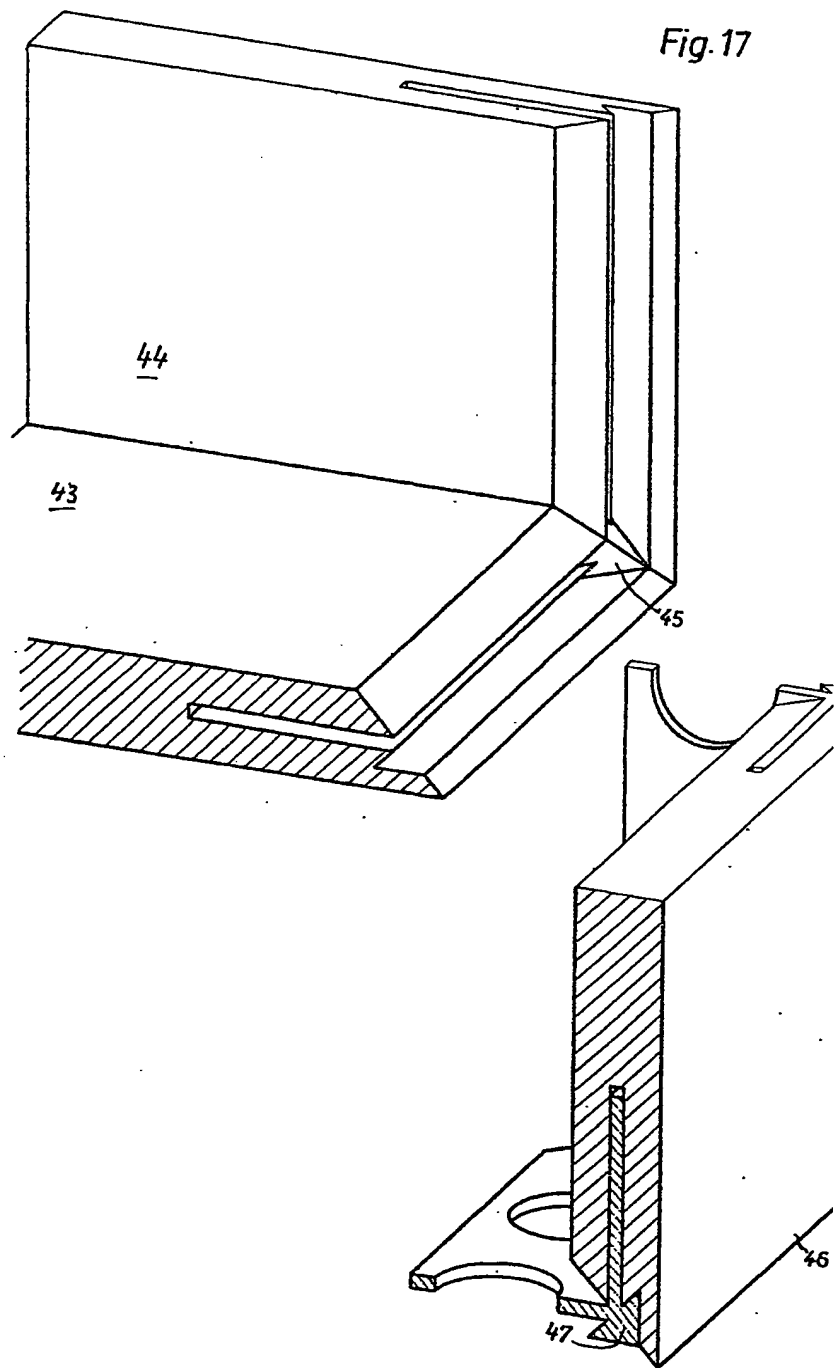


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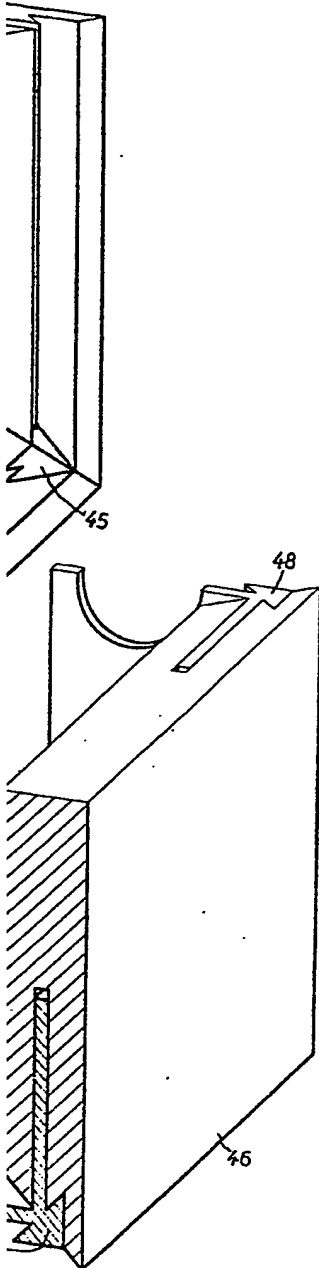


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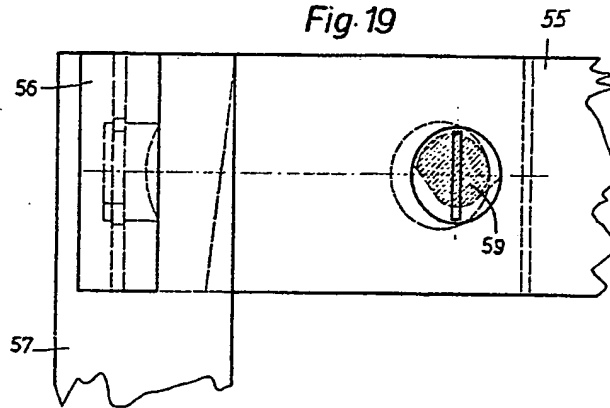


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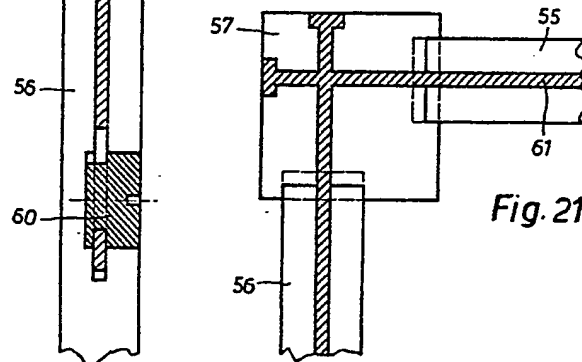
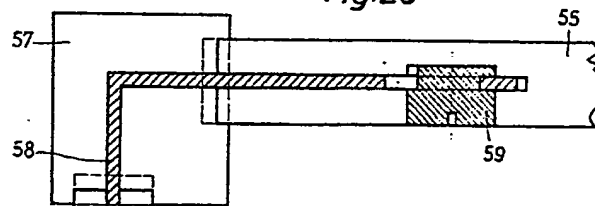


Fig. 21

Fig. 17

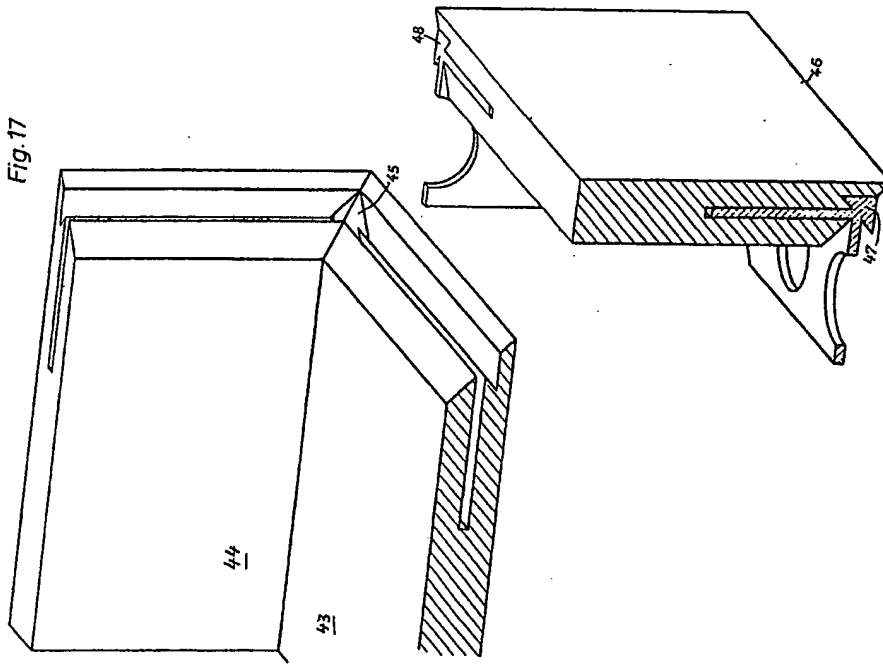


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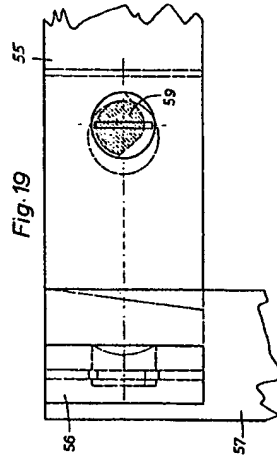


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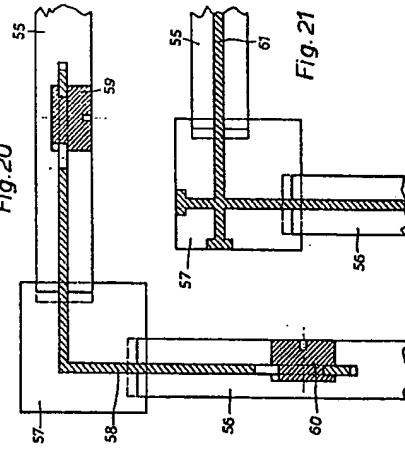
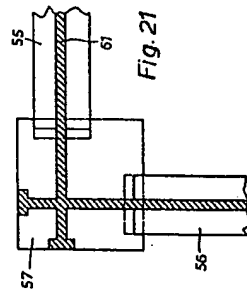


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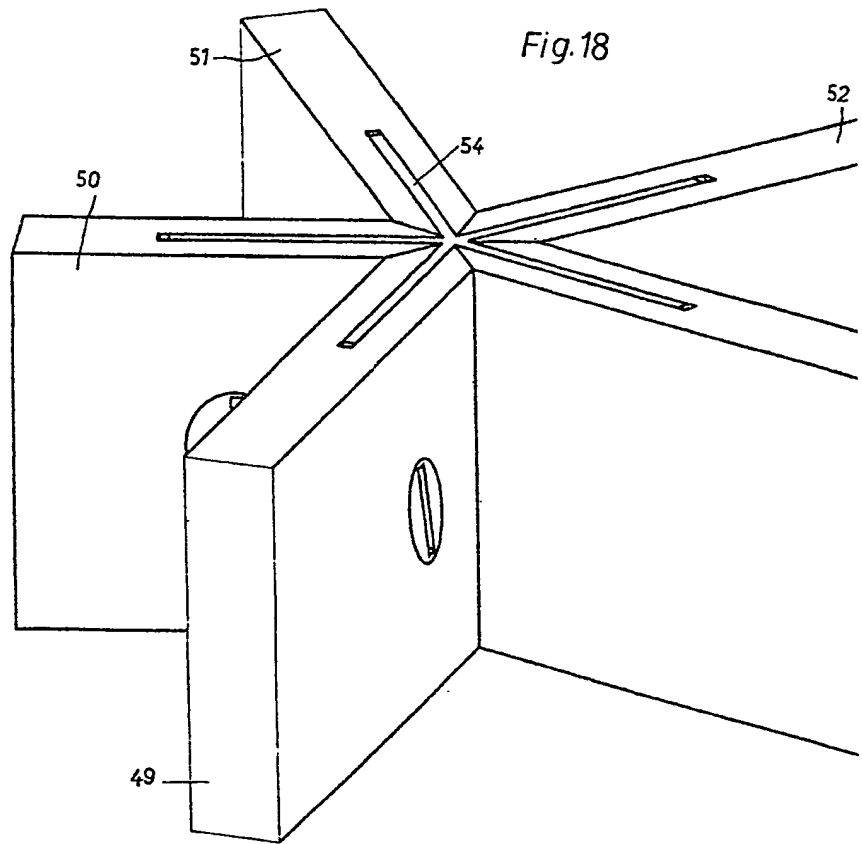
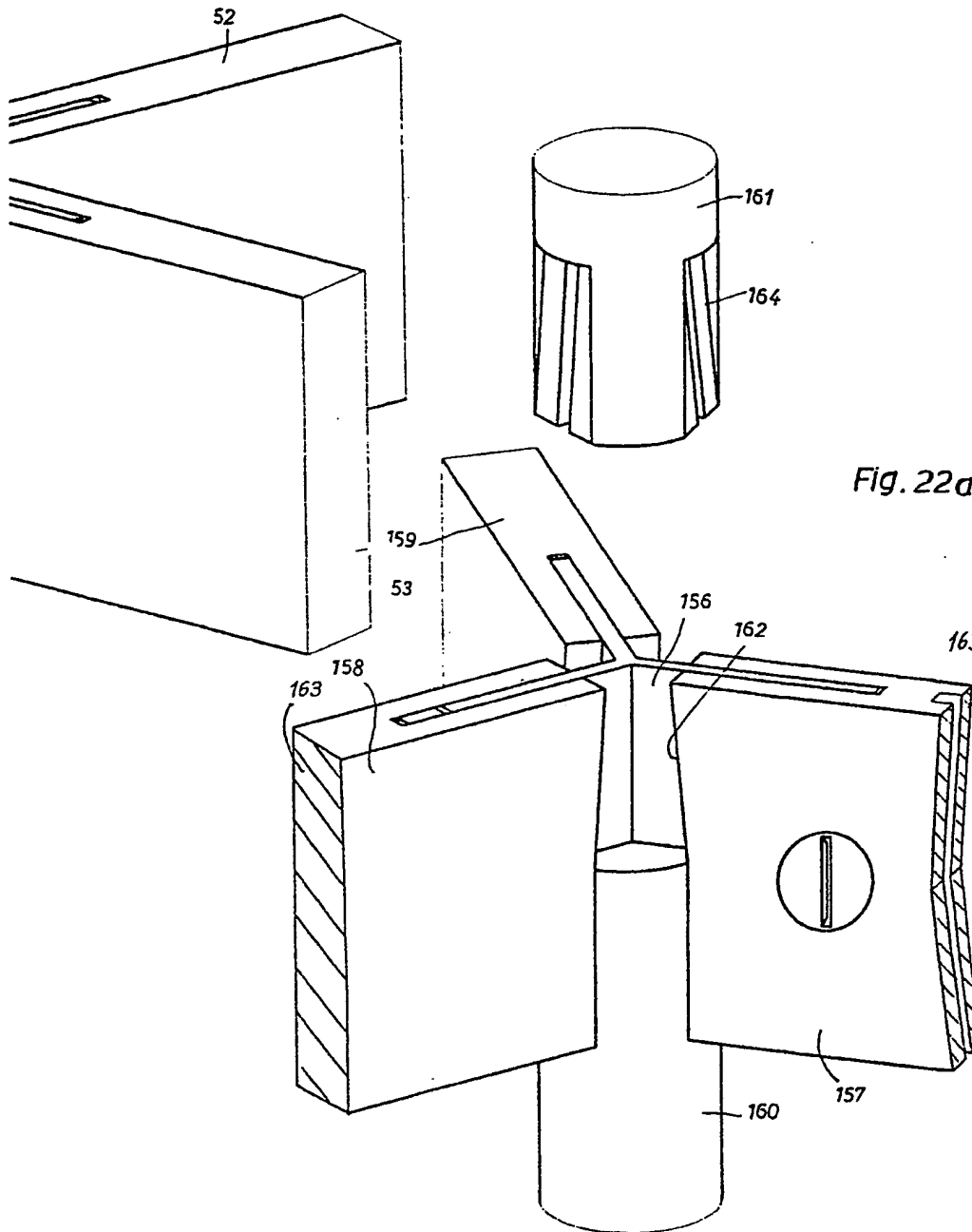


Fig.18



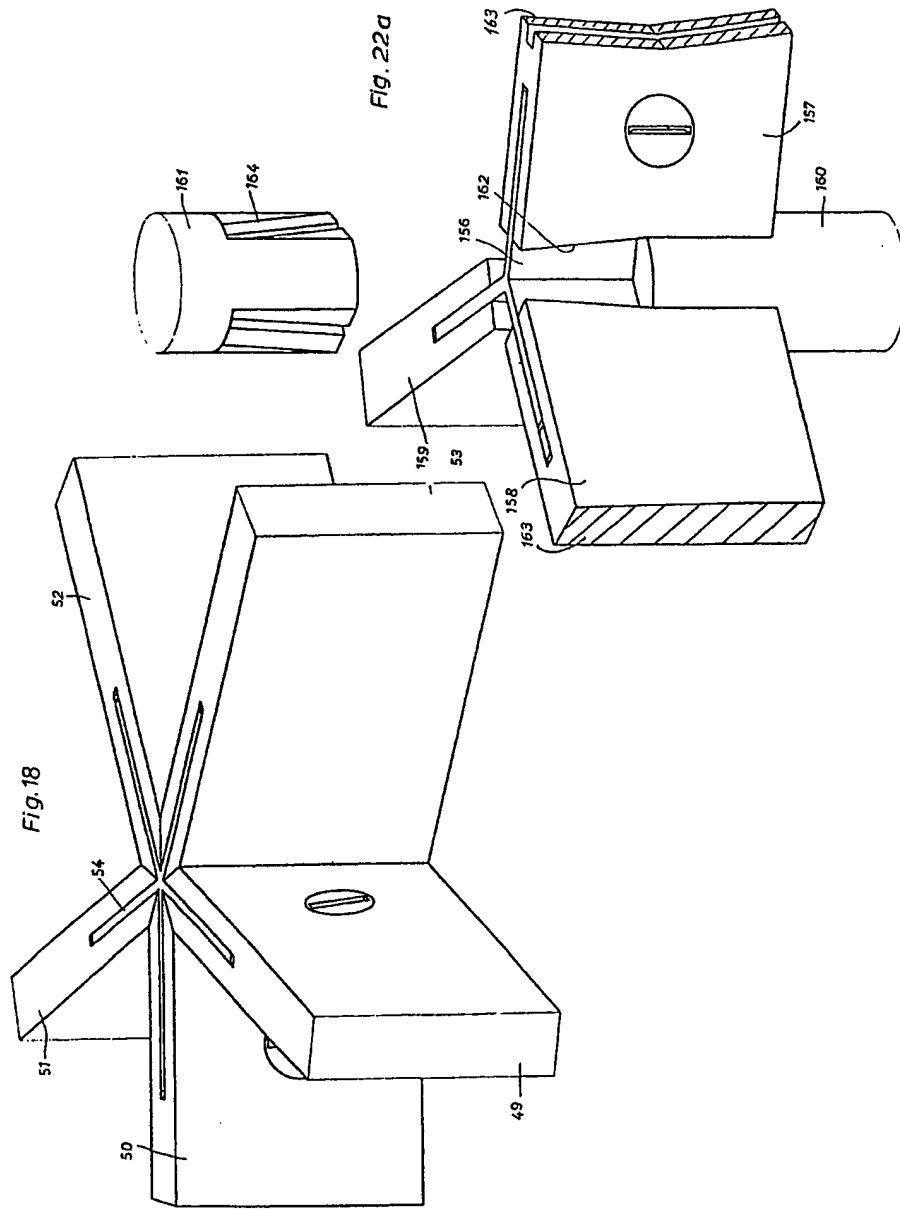


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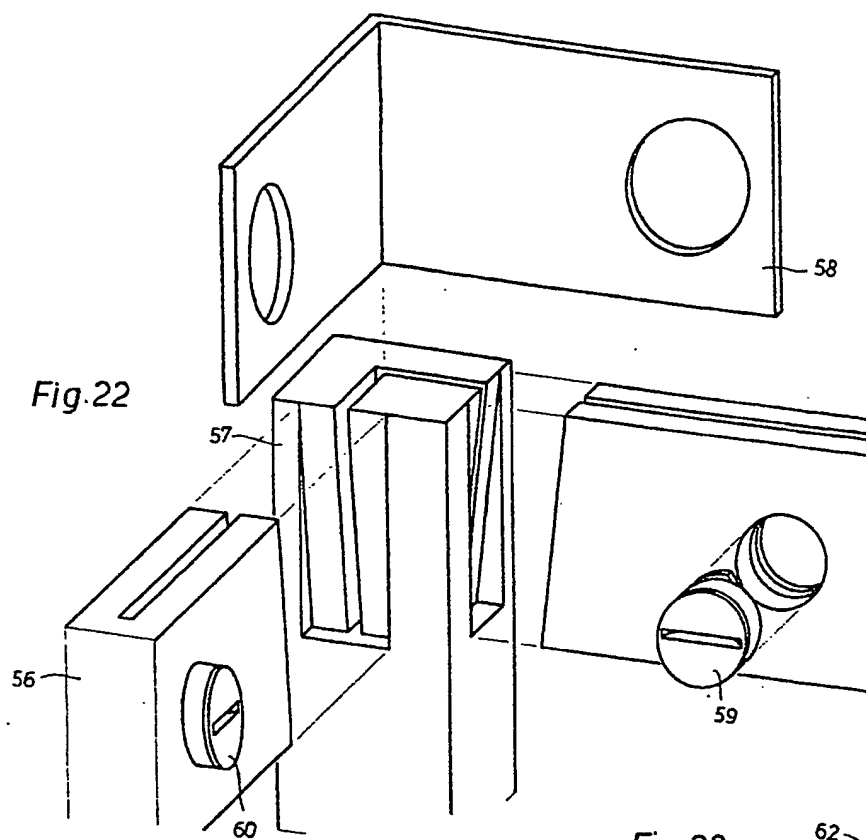
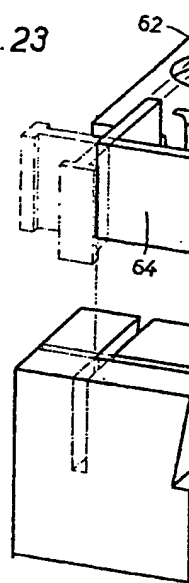
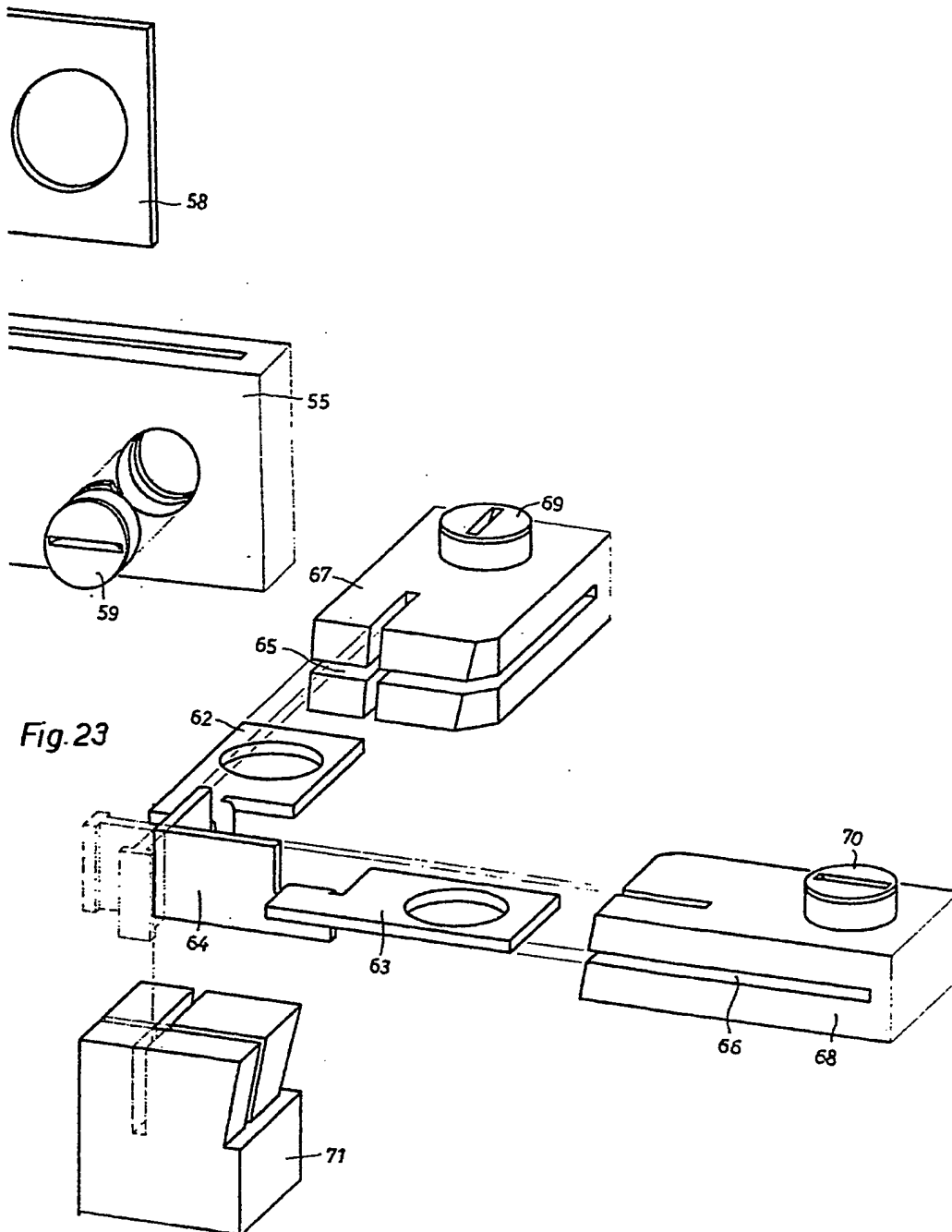


Fig.23





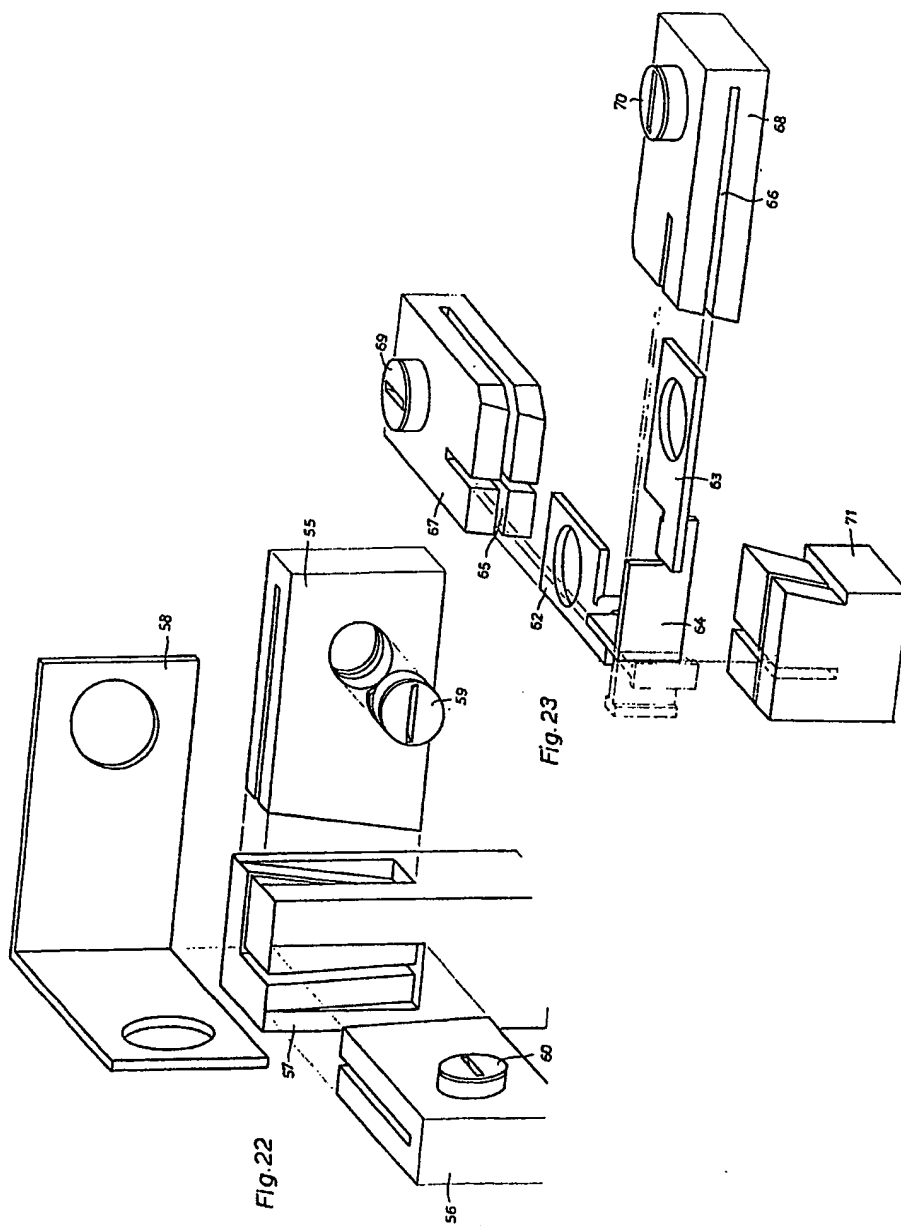


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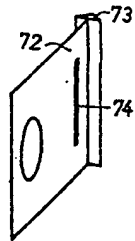


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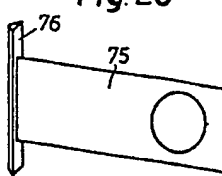


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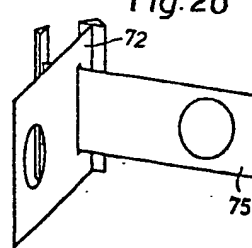


Fig. 29

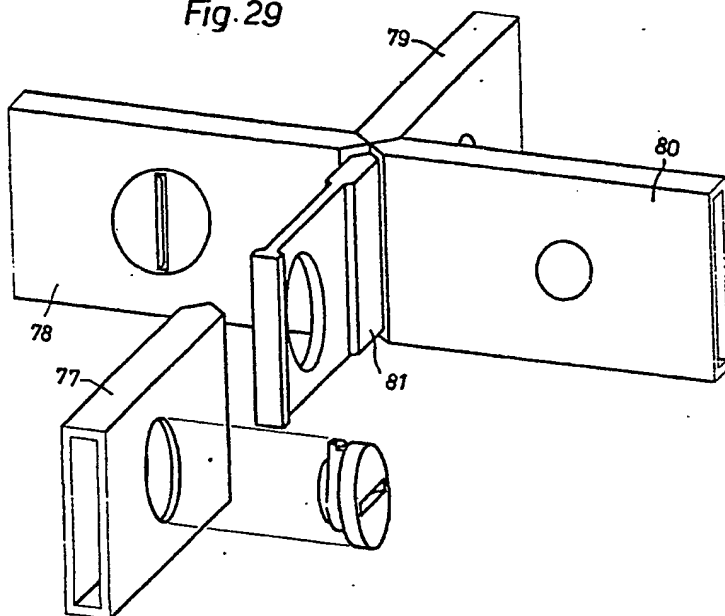


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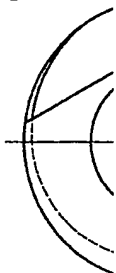
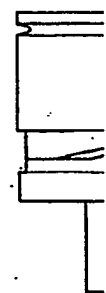


Fig. 29b



g.26

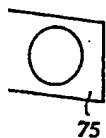


Fig. 27

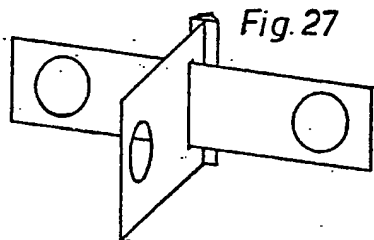


Fig. 28

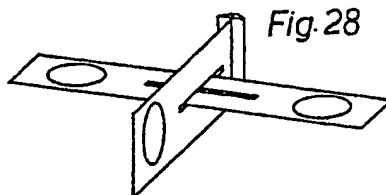


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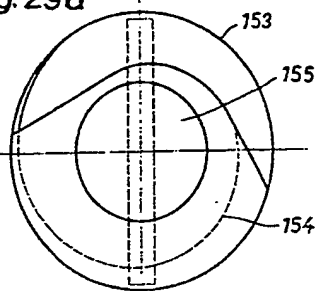
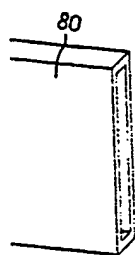


Fig. 29b

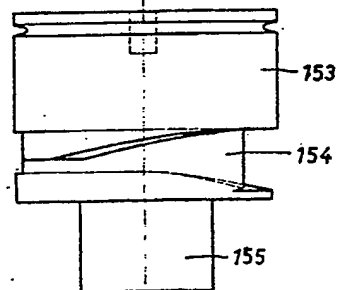
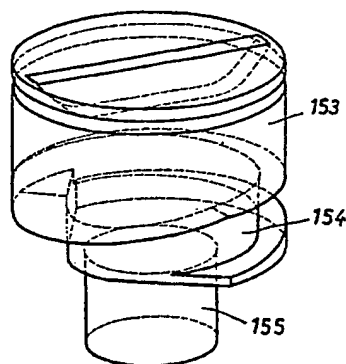


Fig. 29c



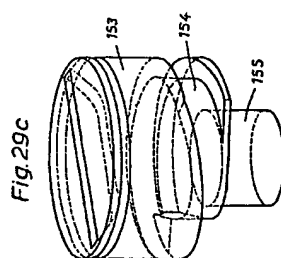
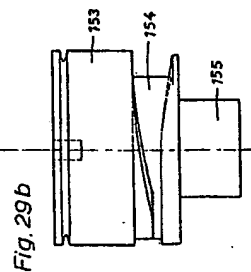
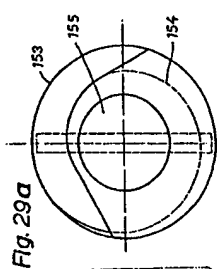
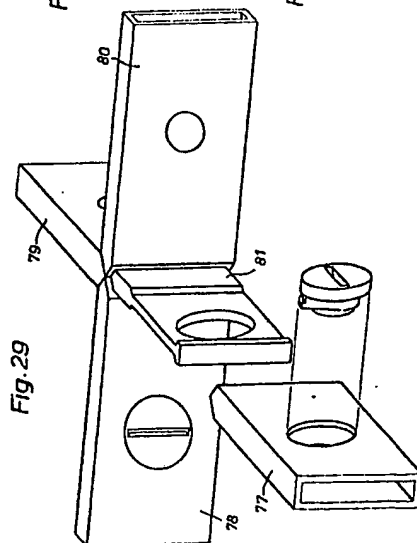
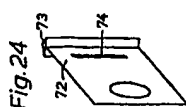
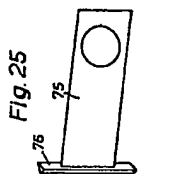
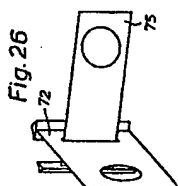
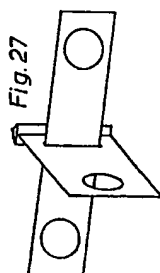
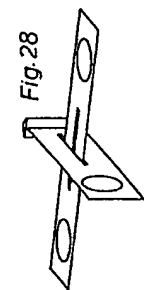


Fig. 30

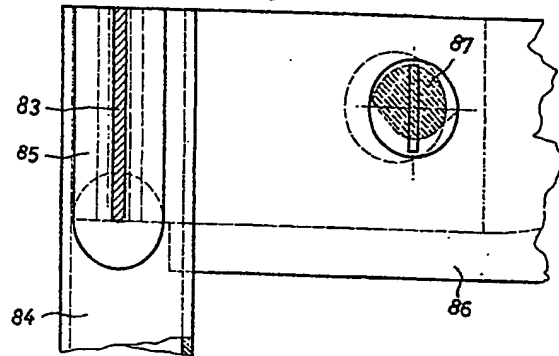


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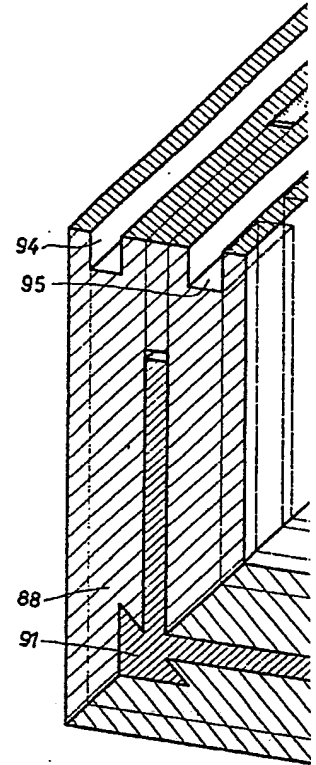
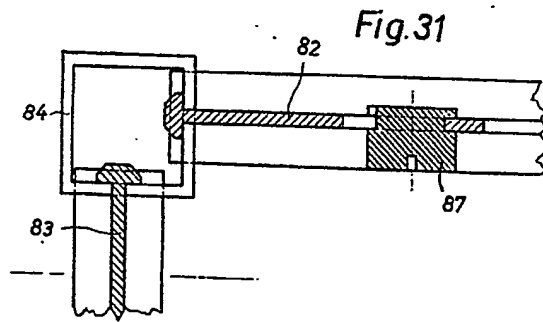


Fig. 32

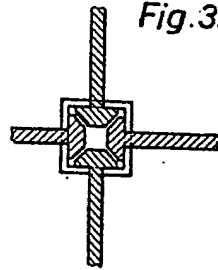


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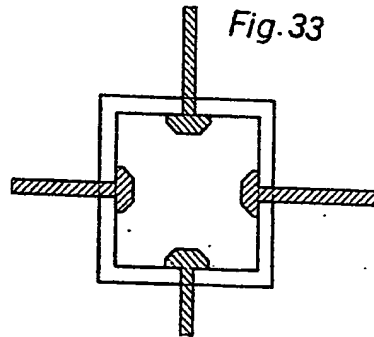
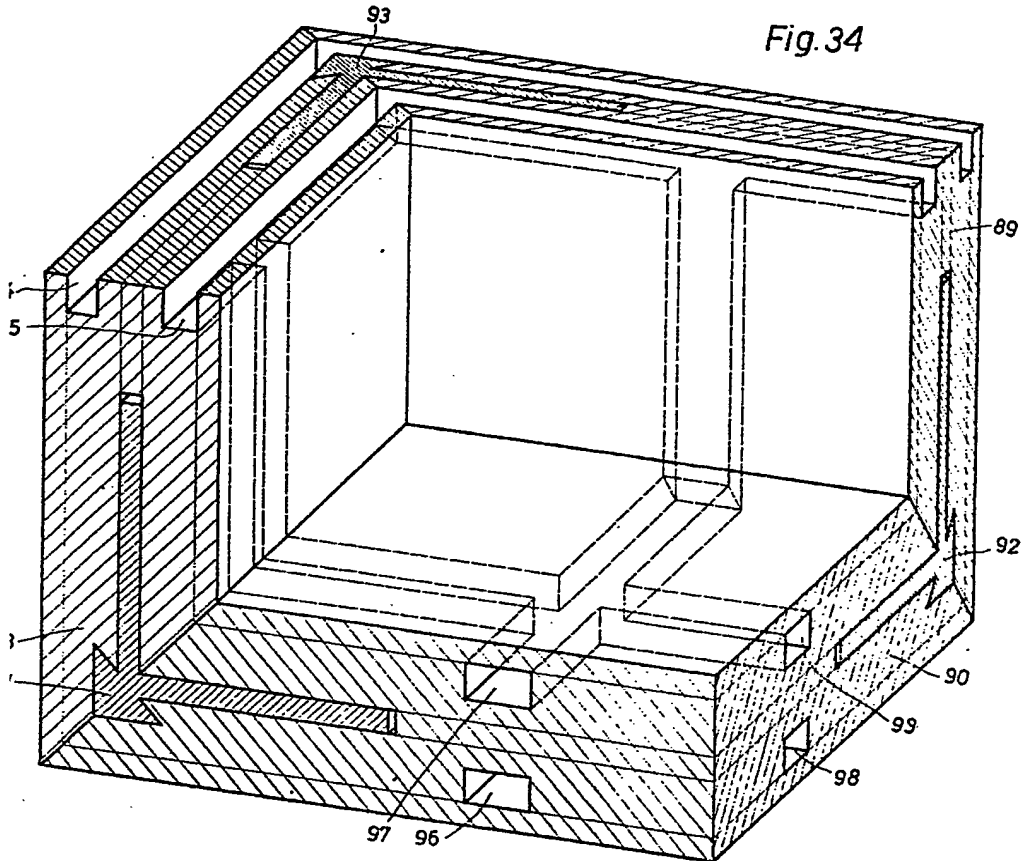


Fig. 34



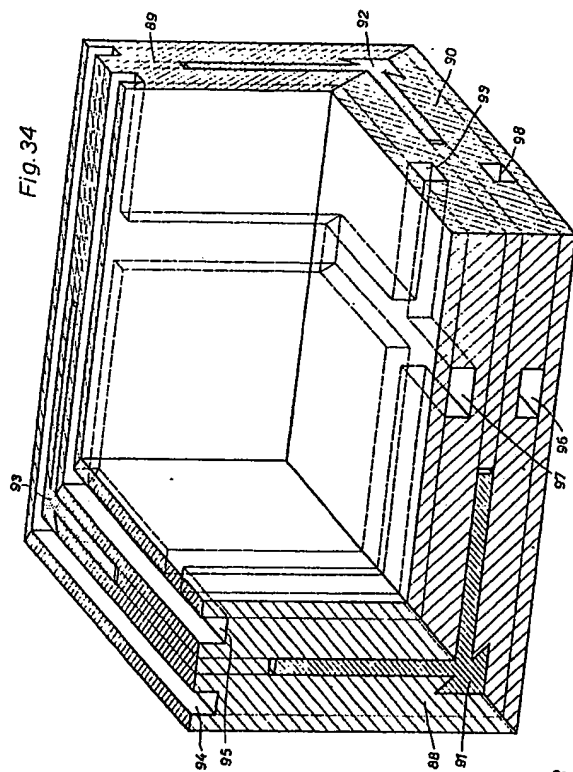
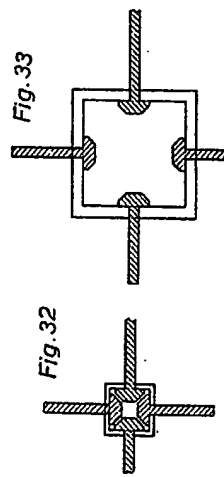
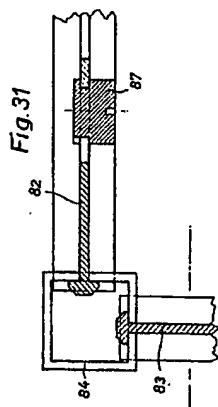
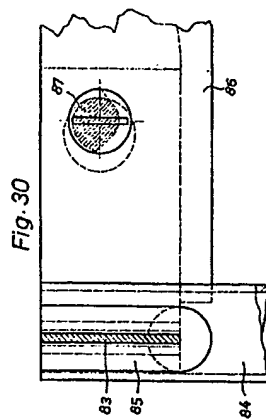


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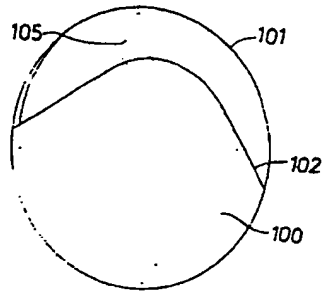


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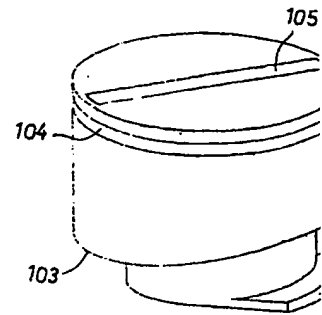


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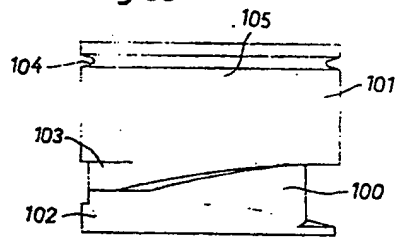


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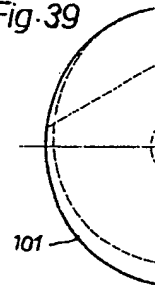


Fig. 38

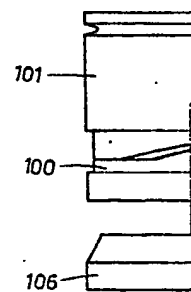


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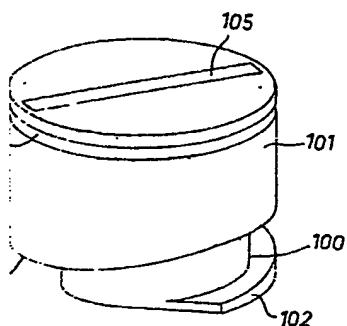


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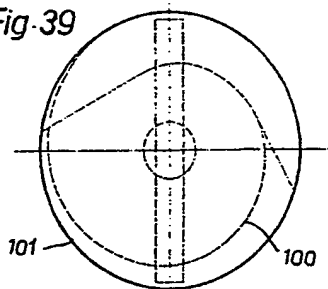


Fig. 38

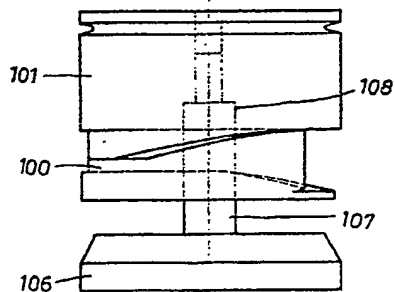


Fig. 40

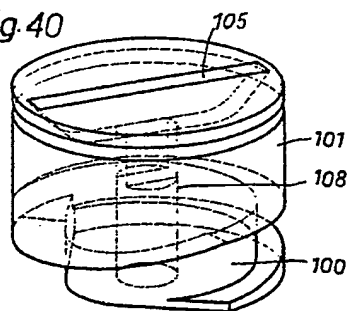


Fig. 41

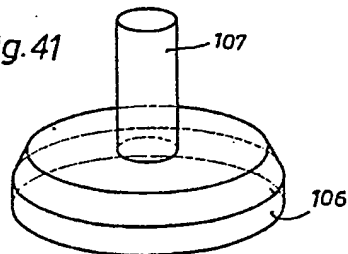


Fig. 36

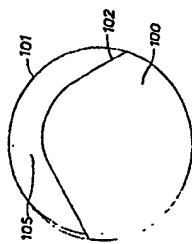


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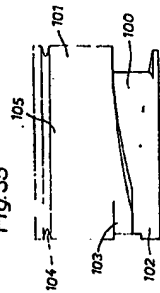


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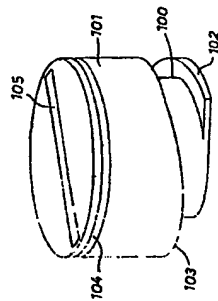


Fig. 39

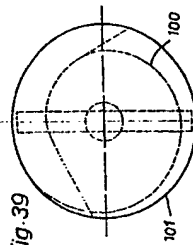


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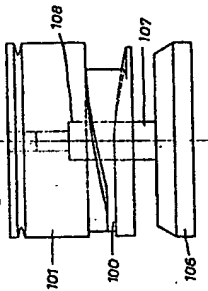


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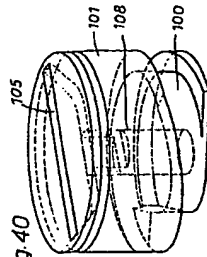


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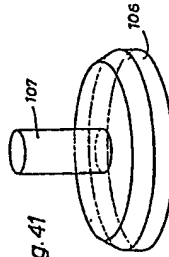


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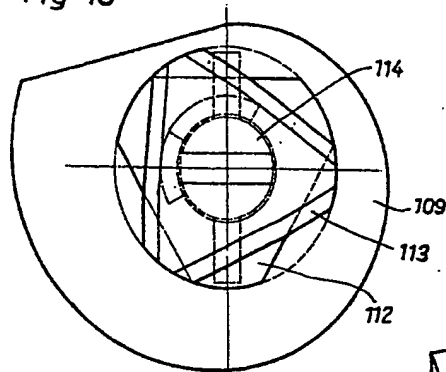


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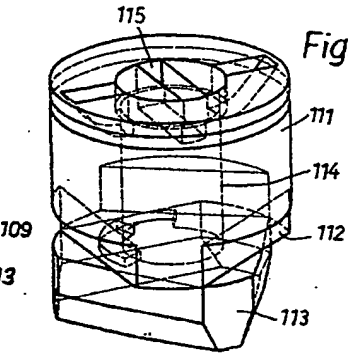


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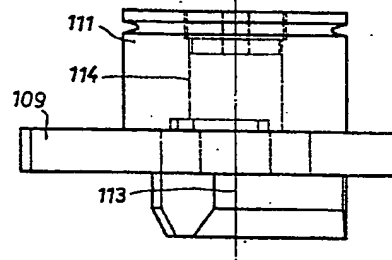


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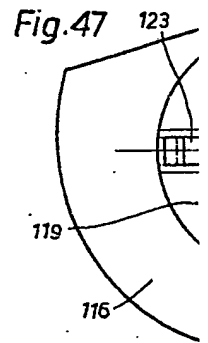
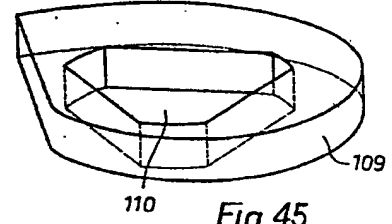
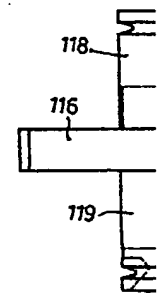


Fig. 46



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COMPLETE SPECIFICATION

10 SHEETS

*This drawing is a reproduction of
the Original on a reduced scale*

Sheet 9

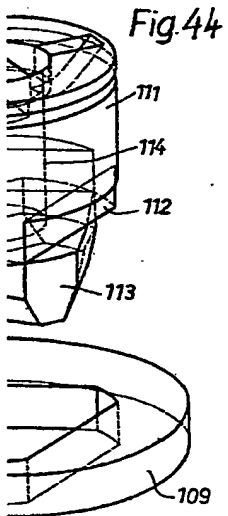


Fig.45

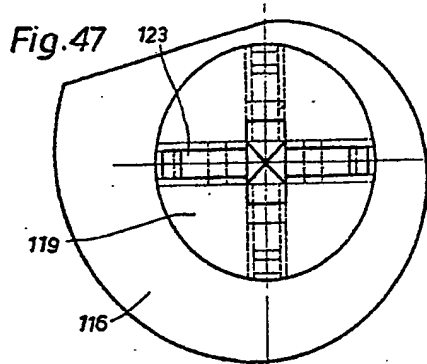
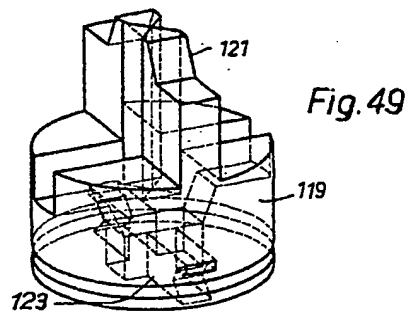
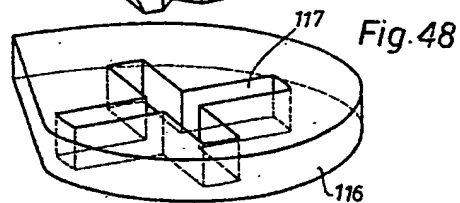
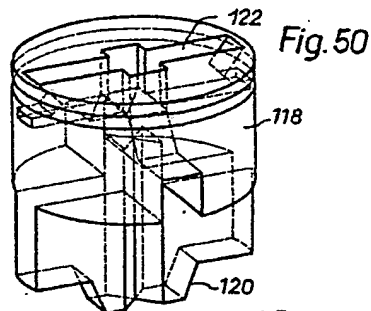
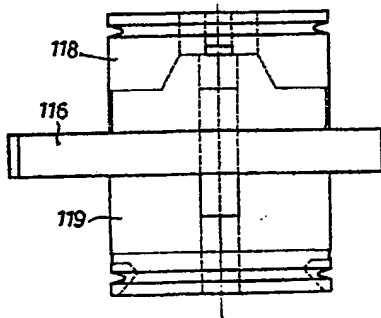


Fig.46



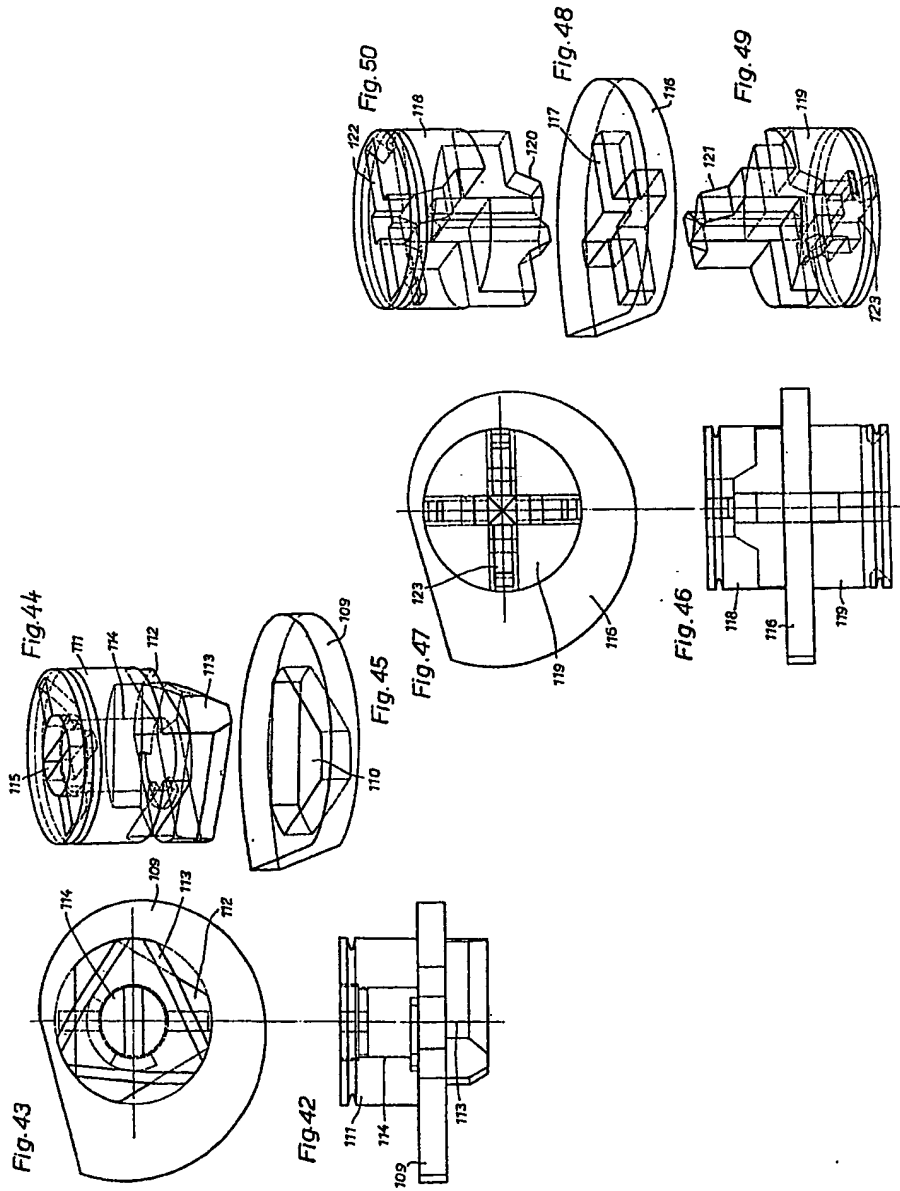
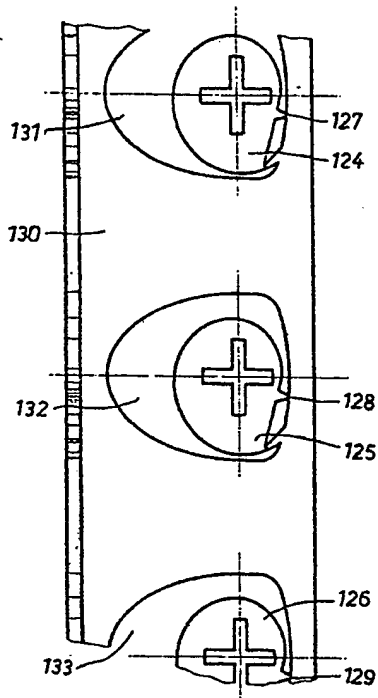


Fig. 51



F

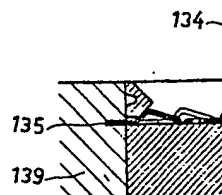


Fig. 54

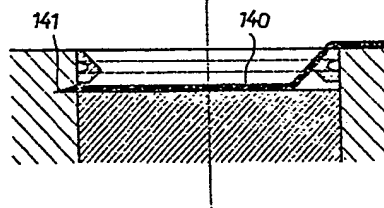


Fig. 56

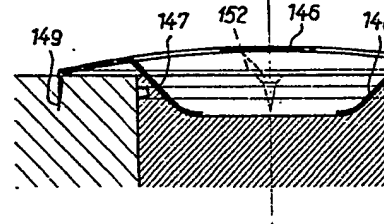


Fig. 52

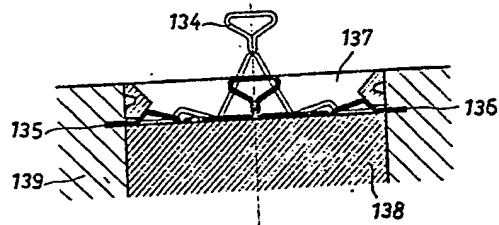


Fig. 53

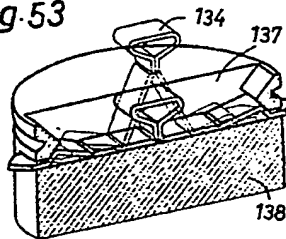


Fig. 54

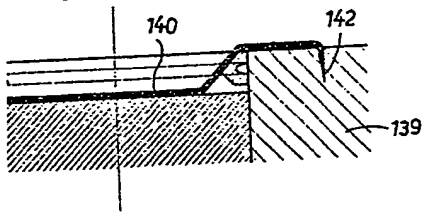


Fig. 55

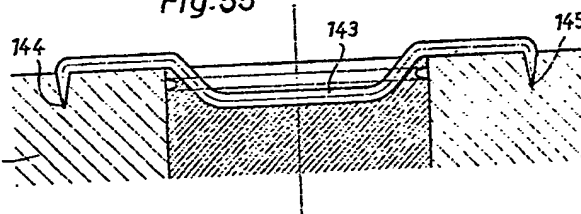


Fig. 56

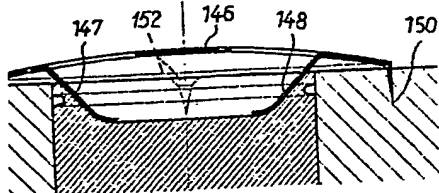
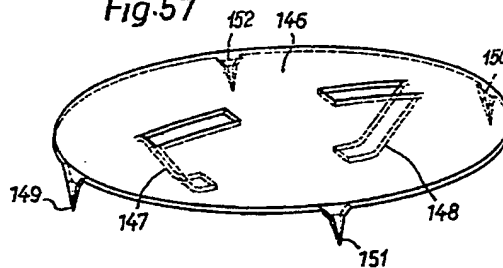


Fig. 57



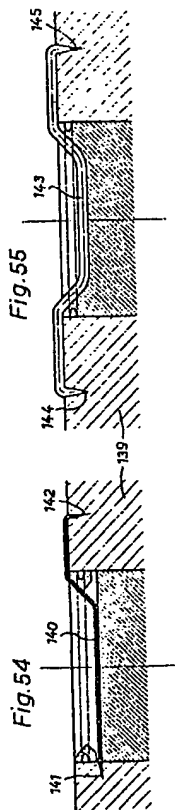
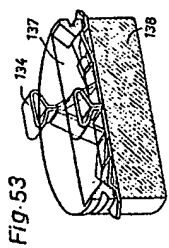
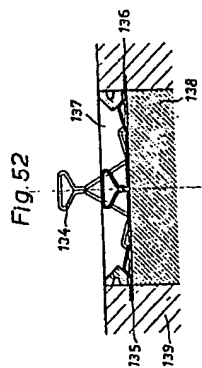
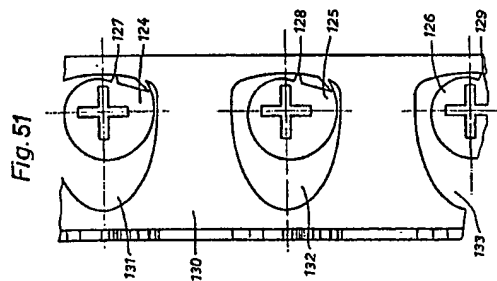


Fig. 55

